NOTICE:

"BEST AVAILABLE COPY"

PORTIONS OF THE FOLLOWING DOCUMENT ARE ILLEGIBLE

The Administrative Record Staff

RESPONSES TO COMMENTS FROM CDPHE AND EPA

ON

DRAFT FINAL TECHNICAL MEMORANDUM NO. 2 EXPOSURE ASSESSMENT HUMAN HEALTH RISK ASSESSMENT FOR OPERABLE UNIT NO. 6 (JUNE 1993)

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, CO

FEBRUARY 1995

GENERAL RESPONSES TO COMMENTS

This document presents DOE's responses to comments provided by the Colorado Department of Health Public and Environment (CDPHE) and the U.S. Environmental Protection Agency (EPA) on Technical Memorandum No. 2 (TM2), Exposure Scenarios, Human Health Risk Assessment, Walnut Creek Priority Drainage, Operable Unit No. 6, Rocky Flats Plant, June 1993 (Draft Final). TM2 was substantially revised in 1994 and a Final TM is being submitted to the agencies.

NOTE: **Many comments refer to proposed site-specific exposure factors. Exposure factors are subject to change, and the responses to comments on them are not intended to bring final resolution to the issues raised.**

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

Specific Comments

Win has been trying to set up a meeting with Bonnie on resolving the Exposure Factors

Our got comments - precipitated w/n trying to set

Comment 1: **Section 2.1, History of IHSS's Within OU6**

The text in this section states that Figure boundary. However, this boundary does n Figure 2-2. This discrepancy needs to be rer

Response: The text no longer says this, and the OU6 bc 3-1.

Comment 2: **Section 2.4, Geology and 2.5.1 Groundwate**

The discussions of the geology and the groundwater in these sections do not reflect more recent information included in an Ebasco study described in Appendix C Addendum of the HAP's Briefing Book No. 12, May, 1993. Please, update the information in these two sections to reflect the current understanding of geology and hydrology.

Response: Text was revised to reflect the current understanding of geology and hydrology in OU6, including information from Appendix C Addendum of the HAP's Briefing Book No. 12.

Comment 3: **Section 3.2.1, Current Off-Site Land Use:**

The last paragraph in this section states, "Current land use in the area immediately east and southeast of OU6 includes all of the uses mentioned above, with the predominant uses are open space (sic), single-family detached dwellings, and horse-boarding operations. Cattle are grazed locally on a seasonal basis. Two small cattle herds (approximately 10 to 20 cattle in each herd) have been observed approximately 2 1/2 miles east and southeast of the Plant. Industrial facilities to the south include the TOSCO laboratory, Great Western Inorganics Plant, and Frontier Forest Products". However, the last paragraph in the next section, 3.2.2, states, "The above information indicates that current land use in the immediate vicinity of the RFP is primarily commercial/industrial and that such land use will continue into the future. It is therefore likely that the potential for residential development in this area will be impeded by the growth of business and industry that is expected to occur."

These two statements are not consistent. Much of the land adjacent to Rocky Flats is currently zoned commercial/industrial. However, that is not the way most of the land is currently used, as pointed out in the first paragraph above, and on Jefferson County Land Use Inventory maps. The Division has consistently commented on this kind of misinterpretation and misrepresentation of the land use situation near Rocky Flats in the Exposure Scenario TMs from other OUs (specifically OUs 2, 7, and 3). These kinds of inconsistencies and misinterpretations must be corrected.

Response: The concluding paragraph was changed to indicate that current and future use of land adjacent to Rocky Flats includes open space, agricultural, commercial/industrial, and residential land use.

Comment 4: **Figure 3-6, Jefferson Center Comprehensive Development Plan:**

What is meant by the "Planned Growth Area" on the buffer zone of the RFP in this map?

Response: Figure 3-6 was removed.

Comment 5: **Figure 3-7:**

The exposure points for the current on-site worker, the future on-site worker, the on-site ecological researcher, and the on-site resident are shown over the whole OU6. Averaging exposure over the whole OU will not meet RCRA requirements or IAG requirements to determine the risk at the source.

Response: Delineation of areas of concern (AOCs) and identification of maximum exposure areas for OU6 are discussed in detail in the CDPHE Letter Report (DOE, 1994). Text has been added to Section 4 in this Exposure Assessment TM explaining the locations of AOCs and maximum exposure areas and the receptor locations for the HHRA.

Comment 6: **Section 4.0, Exposure Pathways:**

Dermal exposure should be included in the human intake route bullet.

Response: The parenthesis referring to intake routes has been removed. Specific intake routes, including that from dermal exposure, are addressed in Section 4.3.

Comment 7: **Section 4.3, Exposure Points, Future Use Scenarios:**

The same comment listed under Figure 3-7 applies here. Risk at each contaminant source must be determined.

The area described under "Ecological researcher" does not include all of OU6. The North Spray field would not be included, for example. This needs to be remedied.

Response: Text has been revised. As discussed in the response to Comment 5, AOCs and maximum exposure areas for each receptor are discussed in detail in Section 4 of this Exposure Assessment TM.

Comment 8: **Section 4.4, Exposure Media:**

The Division does not agree that groundwater is not an exposure medium. Although approximately one half of the monitoring wells were dry following completion, the remaining wells, specifically because they were completed in a dryer time of year (November-January), may constitute reliable, single-family water sources on an daily basis. The Division will apply state ground water standards in lieu of risk assessment; nevertheless, DOE must determine the extent of groundwater contamination, whether state standards are violated and, if necessary, determine remedial actions to remediate ground water resources and protect surface water resources. DOE must rework the subject paragraph to reflect the Division's determination that ground water is a potential pathway subject to state ground water standards.

Response: Text was revised to include groundwater as an exposure medium for the hypothetical future onsite resident.

Comment 9: **Section 4.6.1, Incomplete or Negligible Exposure Pathways for All Receptors:**

Part 1: On Page 4-6, what is the source for the statement, "These animals are not consumed locally"? Agriculture currently exists in nearby off -site areas. Even though it is anticipated that this use will gradually diminish and eventually disappear from parcels closest to the site, and even though the farmers, horse-boarders, etc. may not make their living solely from agriculture, and may not meet DOE's definition of subsistence agriculture, the risks to these residents need to be assessed. As such, at a minimum, off-site residential fruit and vegetable intake needs to be considered. If any farmers in the area eat a substantial portion of homegrown meat or dairy products, their risks must also be considered.

Part 2: The Division has not been convinced that RFP will not be primarily either residential or agricultural in the future. Either of those two uses would be consistent with the type of current use around the Rocky Flats Plant, even though much of the current-zoning is industrial.

Response: **Part 1:** There is no evidence of offsite subsistence farming with respect to ingestion of homegrown meat or dairy products. Thus, pathways associated with subsistence farming are considered incomplete. Ingestion of homegrown produce, affected by deposition of particulate matter (offsite residential) and by root uptake (hypothetical onsite residential), are considered potentially complete pathways and will be evaluated in the HHRA.

Part 2: Both onsite residential and agricultural future land use scenarios are considered improbable, but a hypothetical future onsite residential scenario will be evaluated in the HHRA, including ingestion of homegrown produce. This scenario is conservative and is considered to provide a protective estimate of risk for a maximum exposed individual onsite.

Comment 10: **Section 4.6.5, Future On-Site Construction Worker:**

Part 1: DOE's definition of a construction worker's job as only encompassing construction of a subsurface basement is too narrow. Construction workers also build roads, bridges, etc., all of which conceivably could happen at Rocky Flats in the future. Under both of these latter situations, dermal contact with surface water is reasonable.

Part 2: The Division has decided to accept the argument that inhalation of outdoor volatiles is a minor pathway, even for construction workers, and that it does not need to be assessed.

Part 3: On page 4-12, the words, "and subsoil" should be inserted in the bullet after "Dermal contact with soil."

Response: **Part 1:** The construction worker scenario is used to evaluate potential risk associated with exposure to subsurface soil. Other receptors are assumed to be exposed to surface water (ecological researcher and recreational use by resident).

Part 2: Comment noted.

Part 3: As indicated in this Exposure TM, the future onsite construction worker will be evaluated for exposure to subsurface soil, but not for exposure to surface soil.

Comment 11: Section 4.6.6, Future On-Site Ecological Researcher:

It is unclear why the on-site ecological researcher's inhalation of airborne particulates would be considered "insignificant" when it was significant for the future on-site resident.

Response: The text and conceptual site model were revised to indicate that all onsite inhalation exposures to airborne particulates are considered insignificant but potentially complete pathways.

Comment 12: Section 4.6.7, Future On-Site Residents:

See the comment to Section 4.4 and amend the third paragraph of page 4-14 regarding "Groundwater ingestion is an incomplete pathway..."

Response: Text was revised to indicate that groundwater is an exposure medium for the hypothetical future onsite resident.

Comment 13: Section 5.0, Estimating Chemical Intakes:

On page 5-2, the Division continues to contend that sensitive populations like children (age 0 to 6 years) should be assessed. This recommendation is supported by both EPA (EPA Region 10 guidance on dermal exposure; EPA's Exposure Factors Handbook; EPA's Combustor Emission guidance 1990), the ICRP (1975) and DOE (OU1 and OU3 risk assessments) precedents, by Division policy on RCRA as well as all other CERCLA sites in Colorado, recent NAS recommendations (Pesticides in the Diets of Infants and Children, NAS, 1993), and good risk assessment practice. Specific guidance is available in the above EPA publications. At the minimum, the Division believes the effects of specific chemicals on children should be assessed qualitatively. The IAG states that "both sensitive and potentially exposed populations shall be characterized" (IAG, Attachment 2, VII.D.1.b, p.32).

Response: The revised Exposure Assessment TM indicates that child residential intakes are being estimated for the soil ingestion exposure pathway and that additional potentially complete pathways for children in a residential scenario may be evaluated qualitatively in the uncertainty section of the HHRA. These evaluations should satisfy EPA and CDPHE requirements for discussing potential sensitive

subpopulations in the HHRA. It should also be noted that EPA toxicity values used for chemicals of concern in the HHRA are generally considered to be protective of sensitive subpopulations. For example, chronic RfDs are defined as estimates of daily exposure levels for the human population, including sensitive subpopulations, that are likely to be without an appreciable risk of deleterious effects during a lifetime.

Comment 14: Section 5.1.1, General Exposure Assumptions:

Unless specifically discussed below, the Division generally agrees with the exposure factors and assumptions DOE has chosen.

Part 1: The Division conditionally accepts a longer (6 month) exposure time for a construction worker pending additional information from the regional OSHA office.

Part 2: Division agrees to the use of Ward Whicker's estimates for the times that academic ecological researchers might work at Rocky Flats. It should be noted that the time limitations for this type of ecological researcher would not apply to an ecological worker in a caretaker position, such as might occur if the ecological preserve option occurs. This type of worker is likely to work longer hours, and therefore the exposure calculation would be underestimated for the individual.

Response: **Note: Section 5 in the Exposure Assessment TM has been extensively revised, with most references to exposure parameters removed from the text. Revised exposure factors are presented in Tables 1 through 10 in Attachment 1 of the final TM. Also included in the Tables are references and explanatory text regarding the basis for selecting specific exposure parameters. Therefore, responses to comments on Section 5 are based on information in Attachment 1.**

Part 1: The exposure duration for construction workers presented in the revised tables is 30 days.

Part 2: Comment noted.

Comment 15: Section 5.1.2, Inhalation Assumptions:

Part 1: While Division does not dispute the use of the 75% deposition factor for inhaled particles or the assumption that all deposited chemicals are absorbed, DOE

must consider that RfCs or slope factors are often comparable to delivered doses, not absorbed doses or doses deposited in the lung. It is incumbent on DOE to correctly compare absorbed doses with those RfCs or slope factors that are based on absorbed dose, and administered doses with those RfCs or slope factors that are based on administered dose (RAGS p. A-3). Therefore, DOE cannot apply an absorption factor (regardless of its value) across the board, but can only do so on a chemical-specific basis, when it is appropriate.

Part 2: It should be noted that particles derived both from soil and dried sediment can be inhaled. Are the dried sediment concentrations of various COCs as well as the soil concentrations being factored into the models used to determine air concentrations?

Response: **Part 1:** The revised algorithms for estimation of soil/dust inhalation in this Exposure Assessment TM do not include deposition or absorption factors.

Part 2: Air concentrations of COCs released from surface soil are being modeled for AOC 1 (North Spray Field) and AOC 2 (Triangle Area, Sludge Dispersal Area and Soil Dump Area) for both onsite and offsite impacts. Stream sediment, dry sediment, and pond sediment are considered exposure media in AOCs 3 and 4 (Ponds A-1 through A-3 and Ponds B-1 through B-4, respectively) for the ecological researcher and the recreational user. Onsite air impacts from COCs in stream sediment and dry sediment will be estimated using the particulate emission factor (PEF) from EPA's Risk assessment Guidance for Superfund, Part B. Offsite impacts from stream and dry sediment do not warrant modeling because of the relatively insignificant size of the source. If onsite air impacts exceed a level of concern, potential offsite impacts will be evaluated.

Comment 16: **Section 5.1.3, Soil Ingestion Assumptions:**

Part 1: The fraction contacted (FC) = 0.06 for the current on-site worker appears to have been calculated based on the ratio of the areas at OU6 to the rest of Rocky Flats rather than time. The Division believes that this kind of calculation is unacceptable.

The Division has not accepted the fraction contacted (FC) = 0.5 for any other OU. In the absence of site-specific information, this factor seems rather arbitrary. Moreover, the use of this fraction is not consistent with the determination of the risk

at the source. Furthermore, fraction contacted is not included as acceptable in the Template.

Part 2: Any matrix effect will have to be documented and accepted by EPA and Division before use.

Response: **Part 1:** Table 1, Attachment 1, in the final TM presents exposure factors for the fraction ingested from the contaminated source for each receptor scenario, based on the estimated fraction of time that receptors spend at home or at work onsite. The parameter FC has been retained for the current onsite workers.

Part 2: Comment regarding matrix effect is noted.

Comment 17: **Section 5.1.4, Homegrown Produce Ingestion Assumptions:**

Part 1: Please provide information and references that the assumption that a 90% reduction in chemical concentration on the food surface due to washing of produce applies to organic chemicals and metals as well as to transuranium elements.

Part 2: Division believes that the risks from ingestion of homegrown fruits and vegetables grown off-site which have taken up contaminants from the roots need to be assessed. Reduced bioavailability because of binding to soils or dilution should not be equated with no bioavailability. Moreover, there are a number of contaminants in soil found on the RFP site, and DOE is not taking the risks from exposure to an accumulation of multiple chemicals into account. DOE also is not taking toxicity of possible contaminants or the initial surface concentration into account. Division does not believe that there is a basis for excluding organic chemicals from consideration, and does not agree with the argument that intake from ingestion and dermal contact will greatly exceed intake from fruits and vegetables. For organic chemicals, intake from plant ingestion often exceeds intake from soil ingestion or dermal contact, sometimes by nearly an order of magnitude. Therefore, plant uptake from soils as well as surface deposition should be included in the risk assessment.

Response: **Part 1:** The bases for using a 50% washoff factor are provided in Table 6, Attachment 1.

Part 2: The revised Exposure Assessment TM indicates that future onsite residential receptors will be evaluated for ingestion of homegrown produce contaminated by soil deposition and root uptake, whereas current and future offsite receptors will be evaluated for ingestion of homegrown produce contaminated by soil deposition only. Root uptake is considered negligible offsite because current offsite concentrations of radionuclides do not exceed residential RBCs (see revised TM Section 4.4.2) and additional modeled impacts from dispersion of metals and radionuclides in surface soil and deposition at offsite receptor locations are negligible. Modeling results showing negligible offsite impacts will be included in the RI report and referenced in the risk assessment. There are no organic chemicals of concern in surface soil in OU6, therefore root uptake of organics is not an issue. The statement regarding relative intake from soil ingestion versus produce ingestion has been removed.

Comment 18: Section 5.1.5, Surface Water/Suspended Sediment Ingestion Assumptions:

The Division is not convinced that a future ecological researcher would likely be exposed to sediment and to surface water only 7 events/year, and 2.6 hours/event. This amount of exposure is the average number of times an individual might go swimming (EPA's Exposure Factors Handbook), and thus may be appropriate for a residential scenario. However, it does not really apply to an individual who is performing an ecological research project, which may involve extensive wading when taking samples.

Response: An exposure frequency of 7 days/year and an exposure time of 1 hour/day for the ecological researcher is presented in the revised tables in Attachment 1 of this Exposure Assessment TM.

Comment 19: Section 5.1.6, Dermal Contact with Soil:

Part 1: Most metals are not absorbed well across the skin. Mercury is an exception. How will mercury be assessed should it become a COC?

Part 2: Division contends that the 2,910 cm^2/day for dermal contact with soil for both the residential and occupational receptors is incorrect. An assumption of long sleeved shirts and long pants are appropriate for occupational receptors. Thus, the 2,910 cm^2/day value may be appropriate for occupational receptors. However, this

value is not reasonable or typical for adult residential receptors especially in warm seasons and should be adjusted upwards.

Part 3: Division believes that a soil adherence factor value of 0.5 mg/cm^2 is not in accordance with EPA dermal guidance. The central tendency value is 0.2 mg/cm^2, and an upper value is 1. 0 mg/cm^2. The range of values reported by the EPA's Dermal Exposure Assessment guidance is 0.2-1.5 mg/cm^2 per event.

Response: **Part 1:** Mercury is not a potential chemical of concern in OU6.

Part 2: Revised values for exposed skin surface are presented in Table 3, Soil/Dust Dermal Contact, in Attachment 1 of this Exposure Assessment TM.

Part 3: Revised central tendency (0.2 mg/cm^2) and RME (1.0 mg/cm^2) values for soil adherence are presented in Table 3, in Attachment 1 of the Exposure Assessment TM.

Comment 20: Tables 5-1 through 5-33:

These tables should be amended to reflect the Division's comments above.

Response: Tables 5-1 through 5-33 were removed from Section 5 and replaced with revised Tables 1 through 10 in Attachment 1

ENVIRONMENTAL PROTECTION AGENCY

General Comments

Comment 1: The intent of Technical Memorandum No. 2 is to identify and describe potential reasonable maximum exposure scenarios for present and future human receptors in OU-6 and to identify reasonable maximum intake parameters which will be used to estimate chemical intake. Although the memorandum comprehensively identifies exposure scenarios, the intake parameters presented in some of the scenarios fall short of reasonable maximum values conventionally used for Superfund sites. The parameters should be revised to reflect a more conservative approach which will provide consistency with other RFP operable units and Superfund sites.

Response: Exposure parameters were revised and included in the 1994 Draft Final Exposure Assessment TM for OU6.

Specific Comments

Comment 1: **Page 3-12, Second and Third Paragraphs:**

The text explains in great detail the health and safety programs in place at RFP to protect workers from exposure to chemicals of concern (COCs). OU-6 COCs have not been identified. These paragraphs and other references to the health and safety plans at RFP are not relevant here and should be removed.

Response: Text was revised to remove references to health and safety plans at RFETS.

Comment 2: **Page 4-6, Last Bullet:**

The text states that exposure pathways related to groundwater will not be evaluated for any receptors. Groundwater exposure pathways must be evaluated for future onsite receptors. Although groundwater is currently not used on the site, it may be used as a drinking water source in the future. Arguments presented that available quantity will not support certain withdrawal rates are neither germane nor convincing. Thus, we require that domestic use of onsite groundwater be included in the onsite residential scenario.

Response: Text was revised to include groundwater as an exposure medium for the hypothetical future onsite resident.

Comment 3: **Page 4-12, First Paragraph:**

The statement that inhalation of airborne particulates by future construction workers is likely to be relatively insignificant because of limited duration of exposure is not correct or justified. It is possible that a future construction worker may be onsite for 8 to 10 hours per day. Additionally, inhalation rates are higher for construction workers than other occupational exposures. This statement should be modified as such.

Response: The text was revised to remove this statement

Comment 4: **Page 5-3, Section 5.1.1.1, Fourth Paragraph:**

The exposure duration, time and frequency for all exposure pathways for the future ecological researcher is incorrect. The exposure duration for the future onsite ecological researcher should be 25 years, the exposure frequency should be 250 days/year and the exposure time should be 8 hours per day.

Response: **Note: Section 5 in the Exposure Assessment TM has been extensively revised, with most references to exposure parameters removed from the text. Revised exposure factors are presented in Tables 1 through 10 in Attachment 1 of the Exposure Assessment TM. Also included in the Tables are references and explanatory text regarding the basis for selecting specific exposure parameters. Therefore, responses to comments on Section 5 are based on information in Attachment 1.**

The revised tables in Attachment 1 of this Exposure Assessment TM indicate that the exposure duration for the future ecological researcher is 2.5 years, the exposure frequency is 65 days/year, and the exposure time is 8 hours/day.

Comment 5: **Page 5-5, Section 5.1.3, First Indented Paragraph:**

The soil ingestion rate for an occupational construction worker should be 480 milligrams per day (mg/day) (EPA 1993); the value listed in the text is 50 mg/day which is sufficient for an office worker; however, for a construction worker the higher value should be used. The higher value should be used because it is more health-protective than 50 mg/day, and represents the RME value for soil ingestion by a construction worker in this exposure scenario. The text and corresponding tables should be corrected.

Response: The revised tables in Attachment 1 of this Exposure Assessment TM indicate that the RME soil ingestion rate for the future onsite construction worker is 480 mg/day.

Comment 6: **Page 5-6, First Indented Paragraph:**

The text proposes the use of a "fraction contaminated" factor to modify soil exposure pathways. The fraction-contaminated factor is based on the amount of time that a receptor would spend in the OU-6 portion of the buffer zone each day. The use of

this fraction is inappropriate and could underestimate contaminant intake from soil exposure pathways. It should be eliminated from the intake algorithm. The accompanying tables should be corrected.

Response: Table 1, Attachment 1, presents exposure factors for the fraction ingested from the contaminated source for each receptor scenario, based on the estimated fraction of time that receptors spend at home or at work.

Comment 7: **Page 5-6, Second Indented Paragraph:**

The use of a matrix factor to account for soil bioavailability of ingested contaminants is inappropriate. Chemicals in soil may not be covalently bound to particulates and should be assumed to be available for intestinal absorption until proven otherwise. The matrix factor should be deleted from the equation unless site-specific information becomes available.

Response: The revised intake factor tables in Attachment 1 of this Exposure Assessment TM include a chemical specific matrix factor to account for soil bioavailability of ingested contaminants. If chemical specific parameters are not available, a matrix factor of 1.0 will be used.

Comment 8: **Page 5-7, Fifth Indented Paragraph:**

The text states that a 90 percent reduction in chemical concentration on the food surface due to washing of produce will be assumed. This assumption cannot be verified and is, therefore, inappropriate for this route of exposure. This factor should be removed from the equation.

Response: The basis for using a 50% washoff factor to account for reduction in chemical concentration on the surface of homegrown produce due to washing of produce is provided in Attachment 1, Table 6.

Comment 9: **Page 5-8, Section 5.1.6, Second Indented Paragraph:**

The text states that an exposed body surface area of 2,910 cm^2/day will be used to evaluate dermal contact with soil for all receptors. This value is stated to be representative of face, forearms, and hands. The RME value for face, arms and hands

as listed in the Exposure Factors Handbook (EPA 1989b) is 5,300 cm^2/event and the value for an average case is 2,000 cm^2/event. The surface area value of 5,300 cm^2/event should be used in exposure calculations as an upper bound value. The text and corresponding tables should be corrected.

Response: The revised tables in Attachment 1 of this Exposure Assessment TM indicate an exposed skin surface area of 5,300 cm^2/day for evaluation of dermal contact with soil in current and future residents. Other values are presented for exposed skin surface area for current and future onsite workers.

Comment 10: Page 5-10, First Indented Paragraph:

The text states that the body surface area for future residential receptors is 4,850 cm^2/day. This value is incorrect. EPA (1989b) recommends a total body surface area value of 19,400 cm^2/event for dermal exposure to surface water. The text and corresponding tables should be corrected using a surface area value of 19,400 cm^2/event for this exposure pathway.

Response: The revised tables in Attachment 1 of this Exposure Assessment TM indicate a body surface area value of 18,150 cm^2 for dermal exposure of future residential receptors to surface water.